

Approved: 4-14-09

SUBJECT: NUCLEAR EXPLOSIVE AND WEAPON SURETY PROGRAM

1. POLICY. All nuclear explosives and nuclear explosive operations require special safety, security, and use control consideration because of the potentially unacceptable consequences of an accident or unauthorized act; therefore, a Nuclear Explosive and Weapon Surety (NEWS) Program is established to prevent unintended/unauthorized detonation and deliberate unauthorized use of nuclear explosives.
 - a. The NEWS Program is implemented through this Order and the following Directives:
 - (1) DOE O 452.2D, *Nuclear Explosive Safety*, dated 4-14-09, or successor directive;
 - (2) DOE O 452.4A, *Security and Control of Nuclear Explosives and Nuclear Weapons*, dated 12-17-01, or successor directive;
 - (3) DOE O 452.6A, *Nuclear Weapon Surety Interface with the Department of Defense*, dated 4-14-09, or successor directive;
 - (4) DOE M 452.2-1A, *Nuclear Explosive Safety Manual*, dated 4-14-09, or successor directive; and
 - (5) DOE M 452.2-2, *Nuclear Explosive Safety Evaluation Processes*, dated 4-14-09, or successor directive.
 - b. The objectives of the NEWS Program are:
 - (1) To prevent accidents involving U.S. nuclear weapons and nuclear explosives.
 - (2) To prevent inadvertent or unauthorized use of U.S. nuclear weapons and nuclear explosives.
 - (3) In conjunction with the Department of Defense (DoD), to protect the public health and safety by providing dual-Agency judgment and responsibility for the safety, security, and use control (surety) of nuclear weapons.
 - (4) To establish nuclear explosive surety standards and nuclear weapon design surety requirements.

- (5) To address surety vulnerabilities during all phases of the nuclear weapon life cycle and to upgrade surety during weapon stockpile refurbishments and/or new weapon development.
- (6) To establish requirements and responsibilities for planned nuclear explosive operations (NEOs). [Responses to unplanned events (e.g., Accident Response Group activities) are addressed in DOE O 151.1C, *Comprehensive Emergency Management System*, dated 11-02-05, or successor directive.]

2. CANCELLATION. DOE O 452.1C, Nuclear Explosive and Weapon Surety Program, dated 9-20-05. Cancellation of a directive does not, by itself, modify or otherwise affect any contractual obligation to comply with the directive. Contractor requirements documents (CRDs) that have been incorporated into or attached to a contract remain in effect until the contract is modified to either eliminate requirements that are no longer applicable or substitute a new set of requirements.

3. APPLICABILITY.

- a. Departmental Elements. Except for the exclusion in paragraph 3c, this Order applies to all those Departmental elements that are involved in performing, managing, overseeing, or directly supporting NEWS or associated activities, including those created after the Order is issued. (Go to <http://www.directives.doe.gov/pdfs/reftools/org-list.pdf> for the most current listing of Departmental elements.)

The Administrator will ensure that National Nuclear Security Administration (NNSA) employees and contractors comply with their respective responsibilities under this Order. Nothing in this Order shall be construed to interfere with the NNSA Administrator's authority under section 3212(d) of Public Law (P.L.) 106-65 to establish Administration-specific policies, unless disapproved by the Secretary.

- b. Nuclear Security Enterprise Contractors.

- (1) Except for the exclusions in paragraph 3c, the Contractor Requirements Document (CRD), Attachment 1, sets forth requirements of this Order that will apply to contracts that include the CRD.
- (2) This CRD must be included in all contracts that involve performing, managing, overseeing, or directly supporting NEOs or associated activities.
- (3) Site office managers are responsible for notifying contracting officers of which contracts are affected. Once notified, contracting officers are responsible for incorporating the CRD into each affected contract.

c. Exclusions.

- (1) The following Departmental elements are excluded: Office of the Chief Financial Officer, Office of the Chief Information Officer, Office of Civilian Radioactive Waste Management, Office of Congressional and Intergovernmental Affairs, Office of Economic Impact and Diversity, Energy Information Administration, Office of Electricity Delivery and Energy Reliability, Office of Energy Efficiency and Renewable Energy, Office of Environmental Management, Office of Fossil Energy, Office of Hearings and Appeals, Office of Human Capital Management, Office of Intelligence and Counterintelligence, Office of Legacy Management, Office of Management, Office of Nuclear Energy, Office of Policy and International Affairs, Office of Public Affairs, Office of Science, Bonneville Power Administration, Southeastern Power Administration, Southwestern Power Administration, and Western Area Power Administration.
- (2) In accordance with the responsibilities and authorities assigned by Executive Order 12344, codified at 50 USC sections 2406 and 2511 and to ensure consistency through the joint Navy/DOE Naval Nuclear Propulsion Program, the Deputy Administrator for Naval Reactors (Director) will implement and oversee requirements and practices pertaining to this Directive for activities under the Director's cognizance, as deemed appropriate.

4. REQUIREMENTS.

- a. Nuclear Explosive Surety Standards. All DOE nuclear explosives and nuclear explosive operations must meet the following qualitative surety standards.
 - (1) Nuclear explosive operations must have controls to prevent adverse environments and unauthorized acts that could lead to unintended nuclear detonation or main charge high explosive detonation/deflagration.
 - (2) Nuclear explosive operations must have controls to prevent unintended nuclear detonation and main charge high explosive detonation/deflagration, given an adverse environment or unauthorized act.
 - (3) There must be controls to prevent unauthorized access, intentional physical damage, misuse, and theft of nuclear explosives.
 - (4) There must be controls (a combination of site, facility, or nuclear explosive operation-specific as appropriate) to prevent malevolent acts that could lead to deliberate unauthorized use.
 - (5) New and refurbished nuclear weapons must have design attributes to prevent nuclear detonation and main charge high explosive

detonation/deflagration, given an adverse environment or unauthorized act.

- (6) New and refurbished nuclear weapons must have design attributes to prevent deliberate unauthorized use, given a malevolent act.

b. Application and Intent of the Surety Standards. Organizations involved with NEWS management must use the following guidance in interpreting and applying the Surety Standards of paragraph 4a.

- (1) The term “prevent” implies an absolute assurance, which cannot be guaranteed and is rarely achievable. Nonetheless, prevention of unintended/unauthorized nuclear detonation and unintended main charge high explosive (HE) detonation/deflagration is a primary goal in the design and performance of nuclear explosive operations. The objective is to drive the likelihood of the specified consequences as low as reasonably practicable.
- (2) A primary target of nuclear explosive surety controls is to protect nuclear explosive main charge HE from environments capable of initiating it, including those environments to which main charge detonator cable assemblies are exposed. Adequacy of controls must be established through application of the concept of defense-in-depth (redundancy, diversity, safety margins, etc.) in all stages of nuclear explosive operations. First standard controls prevent or interrupt accidents before environments are created that could initiate detonation/deflagration of main charge HE. Second standard controls protect the main charge HE from initiating environments or mitigate the environment to a level that is incapable of initiating the main charge.
- (3) “Environment” means the aggregate of surrounding conditions, circumstances, objects, and influences. An “adverse environment” is one that is capable of producing an unwanted response. The adverse environments of interest for the Surety Standards are those that, if unmitigated, might lead to nuclear detonation or main charge HE detonation/deflagration. Examples include anything that introduces unintended or unauthorized energy hazardous to a nuclear explosive such as human error; deliberate acts; equipment malfunction; other accident initiators, precursors, or sequences; and the conditions those events create.

c. Nuclear Explosive Safety (NES). The NES Standards, paragraphs 4a(1) and (2) above, must be met for all NEOs conducted by the Department and its contractors to ensure adequate nuclear explosive safety. Nuclear Explosive Safety Study Groups (NESSGs) are convened to evaluate NEOs to determine if controls are adequate to meet these Standards as specified in DOE O 452.2D, *Nuclear Explosive Safety*, and DOE M 452.2-2, *Nuclear Explosive Safety Evaluation Processes*, or their successor directives.

- d. Nuclear Explosive Security. NNSA implements Departmental requirements in accordance with the 470-series directives. Safeguards and security measures must be documented in the site safeguards and security plan. The Security Standard, paragraph 4a(3), above, must be met to ensure adequate nuclear explosive security for all NEOs conducted by the Department and its contractors. The NESSG must evaluate security operations for potential adverse NES impact.
- e. Nuclear Explosive Use Control. The Use Control (UC) Standard, paragraph 4a(4) above, must be met for all NEOs conducted by the Department and its contractors to ensure adequate use control measures. Additional UC requirements are specified in DOE O 452.4A, *Security and Control of Nuclear Explosives and Nuclear Weapons*, or its successor directive. Use control measures must be evaluated in accordance with the provisions of DOE O 452.4A to ensure all objectives are achieved. The NESSG must evaluate UC measures for potential adverse NES impact.
- f. Nuclear Weapon Design Surety. Surety must be an integral part of the design and development of new weapons and the refurbishment of existing weapons. The Nuclear Weapon Design Surety Standards, paragraphs 4a(5) and (6) above must be met to support safe response to adverse environments and unauthorized acts. This is achieved by conforming to the following design criteria.
 - (1) Documented consideration of surety must begin at the conception phase and continue throughout all weapon program phases.
 - (2) Surety-related surveillance program information must be explicitly considered in nuclear weapon design and development activities.
 - (3) The following must be incorporated in new or refurbished nuclear weapon designs unless there are overriding reasons for not doing so and explicitly documented agreements to this effect are reached between the Secretary of Energy and the Secretary of Defense.
 - (a) Nuclear Detonation Safety. Nuclear weapons must incorporate design features that minimize the possibility of accidental and/or inadvertent nuclear detonation. The following are design requirements for nuclear weapons delivered to DoD.
 - 1 Normal Environment. Prior to receipt of the enabling input signals and the arming signal, the probability of a premature nuclear detonation must not exceed one in a billion (1E-09) per nuclear weapon lifetime.
 - 2 Abnormal Environment. Prior to receipt of the enabling input signals, the probability of a premature nuclear detonation must not exceed one in a million (1E-06) per

credible nuclear weapon accident or exposure to abnormal environments.

- 3 One-Point Safety. The probability of achieving a nuclear yield greater than 4 pounds of TNT equivalent in the event of a one-point initiation of the weapon's high explosive must not exceed one in a million (1E-06).
 - (b) Fissile Material Dispersal Safety. Nuclear weapons will incorporate design features for reducing fissile material dispersal from the pit under credible abnormal environments unless there are overriding reasons for not doing so and the responsible military service requests and adequately justifies an exception approved by the Secretary of Energy.
 - (c) Use Control. Nuclear weapons must incorporate use control design features that allow timely authorized use of a nuclear weapon while precluding or delaying unauthorized nuclear detonation. The following are requirements for nuclear weapons delivered to DOD.
 - 1 The protection of nuclear weapons shall include a combination of administrative (e.g., personnel security) and technical measures (e.g., physical security and use control) designed to prevent deliberate unauthorized nuclear detonation. These measures shall be consistent with DOD operational requirements and shall continually be assessed against existing and emerging threats as well as technological opportunities for improvement.
 - 2 Use control capabilities will be upgraded during weapon refurbishment.
 - (d) Inadvertent Criticality. Nuclear weapons designs will preclude inadvertent criticality in both normal and abnormal environments as verified by the design agency.
 - (e) Multipoint Initiation in abnormal environments must be evaluated as part of the design process.
- g. Surety Research and Development (R&D)..
- (1) R&D on a broad range of safety and control methods and devices must be conducted to improve the surety of nuclear weapons and nuclear weapon systems significantly by accomplishing the following:
 - (a) Identify and characterize physical processes that can lead to unacceptable response.

- (b) Identify and address surety issues.
 - (c) Identify areas to improve surety.
 - (2) R&D must provide use control options with delay or denial capability that, at a minimum, are equivalent to that associated with current non-violent disablement systems.
 - (3) R&D must pursue technologies that render the unauthorized use of U.S. nuclear weapons impossible without their remanufacture.
- h. Nuclear Weapon Surveillance Program. The nuclear weapon surveillance program—which involves routine periodic examination, evaluation, and testing of stockpile weapons and weapon components to ensure they meet design requirements and are performing effectively—must include safety and use control components.
- i. Training and Qualification of Personnel. Each organization responsible for and/or involved in NEOs and activities that may affect the safety and use control of a nuclear explosive or nuclear weapon must implement training and qualification programs for personnel.
 - (1) Training and qualification requirements must be commensurate with the particular responsibilities assigned.
 - (2) NEWS training must include specific training on the specific nuclear explosive and weapon hazards and controls for the responsibilities assigned.
 - (3) Training and qualification programs, as a minimum, must be based on the following.
 - (a) 10 CFR Part 712, *Human Reliability Program*, final rule.
 - (b) DOE O 360.1B, *Federal Employee Training*, dated 10-11-01.
 - (c) DOE 5480.20A Chg. 1, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*, dated 07-12-2001, except Chapters II and III.
 - (d) DOE P 426.1, *Federal Technical Capability Policy for Defense Nuclear Facilities*, dated 12-10-98.
 - (e) DOE M 426.1-1A, *Federal Technical Capability Manual*, dated 05-18-04, or successor directive.
- j. Exemptions. Exemptions must be requested when release is sought from a requirement in this Order. The exemption process is outlined in DOE O 251.1C,

Departmental Directives Program, dated 1-15-09, or successor directive. The approval authority is the Deputy Administrator for Defense Programs with concurrence from the Central Technical Authority (CTA).

- k. Records. Records (documentation) must be maintained in accordance with National Archives and Records Administration-approved DOE or site-specific records retention and disposition schedules per DOE O 243.1, *Records Management Program*, dated 2-3-06.
- l. Implementation Requirements
 - (1) This revision does not involve substantive administrative and programmatic changes from the previous directive, DOE O 452.1C, and an implementation plan is not required.
 - (2) This revision is effective upon issue.

5. RESPONSIBILITIES.

- a. NNSA Administrator. Is responsible for the design surety of all nuclear weapons delivered to the DoD and the surety of all NEOs conducted by NNSA and its contractors.
- b. Principal Deputy Administrator. Is the Central Technical Authority for matters covered by this Order.
- c. Deputy Administrator for Defense Programs.
 - (1) Implements DOE/NNSA NEWS Program.
 - (2) Ensures transition from emergency response for nuclear weapons in a damaged or abnormal state (or improvised nuclear device) under DOE 150-series directives to the requirements for planned nuclear explosive operations under the DOE 452-series directives.
- d. Assistant Deputy Administrator Science, Engineering and Production Programs. Ensures an active and continuous review of the nuclear stockpile to identify surety concerns is being conducted and ensures a program to provide for stockpile improvement or controls to address identified concerns.
- e. Director, Office of Military Application and Stockpile Operations.
 - (1) Develops NEWS Program directives.
 - (2) Provides overall NEWS Program management and direction and implements surety policies.

f. Director, Office of Research and Development for National Security Science and Technology.

- (1) Sponsors R&D on a broad range of safety and control methods and devices for nuclear weapons and weapon systems, including use control, and delay and denial capabilities.
 - (a) Identifies and characterizes physical processes that can lead to unacceptable nuclear explosive response.
 - (b) Identifies and addresses surety issues.
 - (c) Identifies areas to improve surety.
 - (d) Ensures that the requirements specified in section 4g of this Order are met.
- (2) Sponsors technologies that render the unauthorized use of nuclear weapons impossible without their remanufacture.

g. Pantex Site Office and Nevada Site Office Managers.

- (1) Ensure (based on competent, independent reviews) that each NEO authorized meets the nuclear explosive surety standards. Retain documentation of these reviews, their conclusions, and resolution of findings.
- (2) Develop and publish site office directives to implement this and related directives as appropriate.

h. Assistant Deputy Administrator for Secure Transportation. Ensures (based on competent, independent reviews) that each NEO authorized meets the nuclear explosive surety standards. Retain documentation of these review, their conclusions, and resolution of findings.

6. DEFINITIONS.

a. Abnormal Environment.

- (1) In Department of Energy operations, an environment that is not expected to occur during nuclear explosive operations and associated activities.
- (2) In Department of Defense operations, as defined in a weapon's stockpile-to-target sequence and military characteristics, those environments in which the weapon is not expected to retain full operational reliability.

- b. Adverse Environment. An “adverse environment” is an environment that is capable of producing an unwanted response. Examples include anything that introduces unintended or unauthorized energy hazardous to a nuclear explosive such as human error; deliberate acts; equipment malfunction; other accident initiators, precursors, or sequences; and the conditions those events create.
- c. Controls. Design features, safety rules, Technical Safety Requirements, procedures, or other positive measures that individually or collectively contribute to nuclear explosive surety.
- d. Deflagration. A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to proceed and accelerate without input of heat from another source. Deflagration is a surface phenomenon, with the reaction products flowing away from the unreacted material along the surface at subsonic velocity. The effect of a true deflagration under confinement is an explosion. Confinement of the reaction increases pressure, rate of reaction, and temperature and may cause transition into a detonation.
- e. Deliberate Unauthorized Use (DUU). Any of the following consequences resulting from deliberate malevolent acts:
 - (1) a nuclear detonation not authorized by the National Command Authorities,
 - (2) a high-explosive detonation or deflagration that could result in an unauthorized nuclear detonation,
 - (3) theft of nuclear explosives.
- f. Documents. Recorded information that describes, specifies, reports, certifies, requires, or provides data or results. A document is not considered a record until it is a completed document that provides objective evidence of an item, service, or process.
- g. Environment. The aggregate of surrounding conditions, circumstances, objects, and influences.
- h. Fissile Material Dispersal. The aerosolization and transport of fissile material by a driving force, such as fire, high-explosive deflagration, or high-explosive detonation.
- i. High-Explosive Detonation. A violent chemical reaction within a chemical compound or mechanical mixture evolving heat and pressure. A detonation is a reaction that proceeds through the reacted material toward the unreacted material at a supersonic velocity. The result of the chemical reaction is exertion of extremely high pressure on the surrounding medium, forming a propagation shock wave that is originally of supersonic velocity.

- j. Inadvertent Criticality. The release of energy as a result of accidental production of a self-sustaining or divergent neutron chain reaction.
- k. Normal Environment.
 - (1) In Department of Energy operations, the environment in which nuclear explosive operations and associated activities are expected to be performed.
 - (2) In Department of Defense operations, the expected logistical and operational environments, as defined in a weapon's stockpile-to-target sequence and military characteristics, that the weapon is required to survive without degradation in operational reliability.
- l. Nuclear Detonation. An energy release through a nuclear process, during a period of time on the order of 1 microsecond, in an amount equivalent to the energy released by detonating 4 or more pounds of trinitrotoluene (TNT).
- m. Nuclear Explosive. An assembly containing fissionable and/or fusionable materials and main charge high-explosive parts or propellants capable of producing a nuclear detonation (e.g., a nuclear weapon or test device).
- n. Nuclear Explosive Area (NEA). An area that contains a nuclear explosive or collocated pit and main charge high-explosive parts.
- o. Nuclear Explosive Operation (NEO). Any activity involving a nuclear explosive including activities in which main charge high-explosive parts and pit are collocated.
- p. Nuclear Explosive Safety (NES). The application of positive measures or controls to prevent or mitigate the possibility of unintended or unauthorized nuclear detonation or HE detonation/deflagration in a nuclear explosive area.
- q. Nuclear Explosive Safety Study (NESS). A formal evaluation of nuclear explosive operations to determine the adequacy of controls to meet the DOE nuclear explosive safety standards.
- r. Nuclear Explosive Safety Study Group (NESSG). The group established to evaluate nuclear explosive operations using the formal processes and certified personnel specified in DOE M 452.2-2, *Nuclear Explosive Safety Evaluation Processes*.
- s. Nuclear Weapon. A nuclear explosive configured for Department of Defense use.
- t. Nuclear Security Enterprise. The collection of DOE laboratories, Nevada Test Site, production plants, and processing facilities involved in the design, production, and testing of nuclear weapons.

- u. Nuclear Yield. The nuclear energy released in the detonation of a nuclear explosive measured in terms of the weight of trinitrotoluene (TNT) required to produce the same amount of energy release.
- v. Pit. A fissile component or set of fissile components designed to fit in the central cavity of an implosion system.
- w. Positive Measures. Design features, safety rules, procedures, or other controls used individually or collectively to provide nuclear explosive surety. Positive measures are intended to ensure a safe response in applicable operations. Some examples of positive measures are strong-link switches; other safety devices; administrative procedures and controls; general and specific nuclear explosive safety rules; design control of electrical equipment and mechanical tooling; and physical, electrical, and mechanical restraints incorporated in facilities and transport equipment.
- x. Records. Records are books, papers, photographs, machine-readable materials, maps, or other documentary materials, regardless of physical form or characteristics, which have documentary or evidential value. Such materials, created or received in connection with the transaction of official business, are preserved because of their informational value as evidence of the organization, functions, policies, decisions, operations, or other activities.
- y. Refurbishment. Any nuclear weapon alterations or modifications including life extension, modernization, and revised military requirements. Refurbishments will be assigned a new alteration or modification number for stockpile management purposes.
- z. Site. A geographical area consisting of a DOE-controlled land area including DOE-owned facilities (e.g., the Nevada Test Site, etc.)
- aa. Surety. Safety, security, and use control of nuclear explosives and nuclear weapons.
- bb. Technical Safety Requirements (TSRs). The limits, controls, and related actions that establish the specific parameters and requisite actions for the safe operation of a nuclear facility and include, as appropriate for the work and the hazards identified in the documented safety analysis for the facility: Safety limits, operating limits, surveillance requirements, administrative and management controls, use and application provisions, and design features, as well as a bases appendix.
- cc. Unauthorized Act. Any action that has not been authorized and approved by proper authority. In the context of the Nuclear Explosive Surety Standards, an unauthorized act is one that is not sanctioned as part of an approved nuclear explosive operation or associated activity, but which could affect a nuclear explosive or main charge high-explosive part in a nuclear explosive area.

Unauthorized acts may be characterized as deliberate or unintended, and as either malevolent or non-malevolent.

- (1) From a NES perspective, an unauthorized act is of interest if performed without intent to compromise nuclear explosive surety (i.e., non-malevolent). This includes cognitive errors (errors of omission or commission) and accidental or inadvertent acts.
 - (2) From a use control perspective, an unauthorized act is of interest if it is both deliberate and malevolent. More specifically, one performed with intent to create an unauthorized nuclear detonation or to gain unauthorized control of a nuclear explosive.
- dd. Use Control. The application of systems, devices, or procedures that allow timely authorized use of a nuclear explosive while precluding or delaying unauthorized nuclear detonation.

7. REFERENCES.

- a. DOE O 151.1C, *Comprehensive Emergency Management System*, dated 11-0-05, provides the framework for development, coordination, control, and direction of all emergency planning, preparedness, readiness assurance, response, and recovery actions.
- b. DOE O 243.1, *Records Management Program*, dated 2-3-06, provides a framework for managing information and National Archives and Records Administration approved DOE or site-specific records schedules.
- c. DOE O 410.1, *Central Technical Authority Responsibilities Regarding Nuclear Safety Requirements*, establishes Central Technical Authority and Chief of Nuclear Safety/Chief of Defense Nuclear Safety responsibilities and requirements directed by the Secretary of Energy in the development and issuance of Department of Energy regulations and directives that affect nuclear safety.
- d. DOE O 414.1C, *Quality Assurance*, dated 6-17-05, requires the implementation of quality assurance criteria.
- e. DOE G 414.1-1B, *Management and Independent Assessments Guide for Use with 10 CFR Part 830, Subpart A, and DOE O 414.1C, Quality Assurance; DOE M 450.4-1, Integrated Safety Management System Manual; and DOE O 226.1A, Implementation of Department of Energy Oversight Policy*, dated 9-27-07, provides information on establishing processes for performing effective assessments. The revision to Guide reflects updated assessment practices, international standards, and changes in DOE expectations.
- f. DOE G 414.1-2A, *Quality Assurance Management System Guide for Use with 10 CFR 830.120 and DOE O 414.1*, dated 6-17-05, provides guidance concerning the

establishment and implementation of an effective quality assurance program or quality management systems and ensures the integrated approach required by DOE P 450.4 (cited below).

- g. DOE O 425.1C, *Startup and Restart of Nuclear Facilities*, dated 3-13-03, establishes the requirements for startup of new nuclear facilities and for the restart of existing nuclear facilities that have been shut down.
- h. DOE P 450.4, *Safety Management System Policy*, dated 10-15-96, describes DOE's commitment that safety management systems be used to integrate safety into management and work practices at all levels so that missions are accomplished while protecting the public, the worker, and the environment.
- i. DOE O 452.2D, *Nuclear Explosive Safety*, dated 4-14-09, establishes requirements and responsibilities for ensuring the nuclear explosive safety of routine and planned DOE NEOs.
- j. DOE M 452.2-1A, *Nuclear Explosive Safety Manual*, dated 4-14-09, addresses mandatory procedures and management processes in selected topical areas to ensure adequate nuclear explosive safety for NEOs conducted by DOE/NNSA, and DOE/NNSA contractors.
- k. DOE M 452.2-2, *Nuclear Explosive Safety Evaluation Processes*, dated 4-14-09, detailing administrative and procedural requirements for nuclear explosive safety evaluations of nuclear explosive operations conducted by the DOE/NNSA, and its respective contractors.
- l. DOE O 452.4A, *Security and Control of Nuclear Explosives and Nuclear Weapons*, dated 12-17-01, establishes DOE requirements and responsibilities to prevent the deliberate unauthorized use of U.S. nuclear explosives and weapons.
- m. DOE O 452.6A, *Nuclear Weapon Surety Interface With the Department of Defense*, dated 4-14-09, establishes DOE/NNSA requirements and responsibilities for addressing joint nuclear weapon and nuclear weapon system surety activities in conjunction with the DOD.
- n. DOE O 461.1A, *Packaging and Transfer or Transportation of Materials of National Security Interest*, dated 4-26-04, establishes DOE requirements and responsibilities for the Transportation Safeguards System Program.
- o. DOE O 470.2B, *Independent Oversight and Performance Assurance Program*, dated 10-31-02, establishes requirements and responsibilities for the DOE Independent Oversight and Performance Assurance Program that provides DOE and contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and the effectiveness of line management performance in safeguards and security and other critical functions.

- p. DOE O 470.4A, *Safeguards and Security Program*, dated 5-27-07, establishes roles and responsibilities for the Department of Energy Safeguards and Security Program.
 - q. 10 CFR Part 712, *Human Reliability Program*.
 - r. 10 CFR Part 820, *Procedural Rules for DOE Nuclear Activities*.
 - s. 10 CFR Part 830, *Nuclear Safety Management*.
 - t. 10 U.S.C. Sec. 179, *Nuclear Weapons Council*.
 - u. Title XXXII of P.L. 106-65, National Nuclear Security Administration Act, as amended, establishes the National Nuclear Security Administration.
 - v. National Security Presidential Directive–28, dated June 20, 2003.
8. CONTACT. Questions concerning this Order should be addressed to the Nuclear Weapon Surety and Quality Division, 202-586-5624.



STEVEN CHU
Secretary of Energy

CONTRACTOR REQUIREMENTS DOCUMENT
DOE O 452.1D, *NUCLEAR EXPLOSIVE AND WEAPON SURETY PROGRAM*

Nuclear Security Enterprise contractors, including National Nuclear Security Administration (NNSA) contractors that conduct Department of Energy (DOE) Nuclear Explosive and Weapon Surety (NEWS) Program activities must comply with the requirements in this Contractor Requirements Document (CRD).

Regardless of the performer of the work, contractors are responsible for compliance with the requirements of this CRD. Contractors are responsible for flowing down the requirements of this CRD to subcontracts at any tier to the extent necessary to ensure the contractors' compliance with the requirements. Contractors must not flow down requirements to subcontractors unnecessarily or imprudently. That is, contractors will ensure that they and their subcontractors comply with the requirements of the CRD and incur only those costs that would be incurred by a prudent person in the conduct of competitive business.

All contractors with this CRD incorporated in their contracts must comply with the following requirements.

1. All nuclear explosives and nuclear explosive operations require special safety, security, and use control consideration because of the potentially unacceptable consequences of an accident or unauthorized act; therefore, a NEWS program shall be established to prevent unintended/unauthorized detonation and deliberate unauthorized use of nuclear explosives.
2. Ensure that all nuclear explosives and nuclear explosive operations under their purview meet the following qualitative DOE surety standards.
 - a. Nuclear explosive operations must have controls to prevent adverse environments and unauthorized acts that could lead to unintended nuclear detonation or main charge high explosive detonation/deflagration.
 - b. Nuclear explosive operations must have controls to prevent nuclear detonation and main charge high explosive detonation/deflagration, given an adverse environment or unauthorized act.
 - c. There must be controls to prevent unauthorized access, intentional physical damage, misuse, and theft of nuclear explosives.
 - d. There must be controls (a combination of site, facility or nuclear explosive operation-specific as appropriate) to prevent malevolent acts that could lead to deliberate unauthorized use.
 - e. New and refurbished nuclear weapons must have design attributes to prevent nuclear detonation and main charge high explosive detonation/deflagration, given an adverse environment or unauthorized act.

- f. New and refurbished nuclear weapons must have design attributes to prevent deliberate unauthorized use, given a malevolent act.
3. Application and Intent of the Surety Standards. Contractors must use the following guidance in interpreting and applying the Surety Standards of paragraph 2.
 - a. The term “prevent” implies an absolute assurance, which cannot be guaranteed and is rarely achievable. Nonetheless, prevention of unintended/unauthorized nuclear detonation and unintended main charge high explosive (HE) detonation/deflagration is a primary goal in the design and performance of nuclear explosive operations. The objective is to drive the likelihood of the specified consequences as low as reasonably practicable.
 - b. A primary target of nuclear explosive surety controls is to protect nuclear explosive main charge HE from environments capable of initiating it, including those environments to which main charge detonator cable assemblies are exposed. Adequacy of controls must be established through application of the concept of defense-in-depth (redundancy, diversity, safety margins, etc.) in all stages of nuclear explosive operations. First standard controls prevent or interrupt accidents before environments are created that could initiate detonation/deflagration of main charge HE. Second standard controls protect the main charge HE from initiating environments or mitigate the environment to a level that is incapable of initiating the main charge.
 - c. “Environment” means the aggregate of surrounding conditions, circumstances, objects, and influences. An “adverse environment” is one that is capable of producing an unwanted response. The adverse environments of interest for the Surety Standards are those that, if unmitigated, might lead to nuclear detonation or main charge HE detonation/deflagration. Examples include anything that introduces unintended or unauthorized energy hazardous to a nuclear explosive such as human error; deliberate acts; equipment malfunction; other accident initiators, precursors, or sequences; and the conditions those events create.
4. Nuclear Explosive Safety (NES). The NES Standards, paragraphs 2a and 2b above, must be met for all NEOs conducted by contractors to ensure adequate nuclear explosive safety.
5. Nuclear Explosive Security. The Security Standard, paragraph 2c, above, must be met to ensure adequate nuclear explosive security for all NEOs conducted by contractors.
6. Nuclear Explosive Use Control. The Use Control Standard, paragraph 2d above, must be met for all NEOs conducted by contractors to ensure adequate use control measures.
7. Nuclear Weapon Design Surety. Surety must be an integral part of the design and development of new weapons and the refurbishment of existing weapons. Contractors operating national laboratories with design responsibilities must do the following.

- a. Document consideration of surety, beginning at the conception phase and continuing throughout all weapon program phases.
- b. Explicitly consider surety-related surveillance program information in nuclear weapon design and development activities.
- c. Incorporate the following in new or refurbished nuclear weapon designs unless there are overriding reasons for not doing so and explicitly documented agreements to this effect are reached between the Secretary of Energy and the Secretary of Defense.
 - (1) Nuclear Detonation Safety. Nuclear weapons must incorporate design features that minimize the possibility of accidental and/or inadvertent nuclear detonation. The following are design requirements for nuclear weapons delivered to DoD.
 - (a) Normal Environment. Prior to receipt of the enabling input signals and the arming signal, the probability of a premature nuclear detonation must not exceed one in a billion (1E-09) per nuclear weapon lifetime.
 - (a) Abnormal Environment. Prior to receipt of the enabling input signals, the probability of a premature nuclear detonation must not exceed one in a million (1E-06) per credible nuclear weapon accident or exposure to abnormal environments.
 - (a) One-Point Safety. The probability of achieving a nuclear yield greater than 4 pounds of TNT equivalent in the event of a one-point initiation of the weapon's high explosive must not exceed one in a million (1E-06).
 - (2) Fissile Material Dispersal Safety. Incorporate design features in nuclear weapons for reducing fissile material dispersal from the pit under credible abnormal environments unless there are overriding reasons for not doing so and the responsible military service requests and adequately justifies an exception approved by the Secretary of Energy.
 - (3) Use Control. Incorporate use control design features in nuclear weapons that allow timely authorized use of a nuclear weapon while precluding or delaying unauthorized nuclear detonation. The following are requirements for nuclear weapons delivered to DoD.
 - (a) The protection of nuclear weapons shall include a combination of administrative (e.g., personnel security) and technical measures (e.g., physical security and use control) designed to prevent deliberate unauthorized nuclear detonation. These measures shall be consistent with DoD operational requirements and shall

continually be assessed against existing and emerging threats as well as technological opportunities for improvement.

- (a) Use control capabilities will be upgraded during weapon refurbishment.
 - (4) Inadvertent Criticality. Design nuclear weapons to preclude inadvertent criticality in both normal and abnormal environments.
 - (5) Multipoint Initiation in abnormal environments must be evaluated as part of the design process.
- d. Surety Research and Development (R&D).
- (1) R&D on a broad range of safety and control methods and devices must be conducted to improve the surety of nuclear weapons and nuclear weapon systems significantly by accomplishing the following:
 - (a) Identify and characterize physical processes that can lead to unacceptable nuclear explosive response.
 - (b) Identify and address surety issues.
 - (c) Identify areas to improve surety.
 - (2) R&D must provide use control options with delay or denial capability that, at a minimum, are equivalent to that associated with current non-violent disablement systems.
 - (3) R&D must pursue technologies that render the unauthorized use of U.S. nuclear weapons impossible without their remanufacture.
8. Nuclear Weapon Surveillance Program. Evaluate the stockpile continually to ensure that safety and use control devices and components meet specified requirements and are performing effectively.
9. Training and Qualification of Personnel. Each organization responsible for and/or involved in NEOs and activities that may affect the safety and use control of a nuclear explosive or nuclear weapon must implement training and qualification programs for personnel.
- a. Training and qualification requirements must be commensurate with the particular responsibilities assigned.
 - b. NEWS training must include specific training on the specific nuclear explosive and weapon hazards and controls for the responsibilities assigned.

- c. Training and qualification programs, as a minimum, must be based on the following.
 - (1) 10 CFR Part 712, *Human Reliability Program*, final rule.
 - (2) DOE 5480.20A Chg. 1, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*, dated 07-12-01, except Chapters II and III.
- 10. Nuclear Security Enterprise Support. Provide qualified personnel to participate in readiness reviews and preparation and/or reviews of NEO hazards analysis reports, safety analysis reports, military Nuclear Weapon System Safety Groups, nuclear weapon surveillance program, nuclear explosive safety evaluation activities, and nuclear explosive safety change evaluation process, and provide other specialized nuclear explosive technical support and assistance.
- 11. Records. Records (documentation) must be maintained in accordance with National Archives and Records Administration-approved DOE or site-specific records retention and disposition schedules per DOE O 243.1, *Records Management Program*, dated 2-3-06.